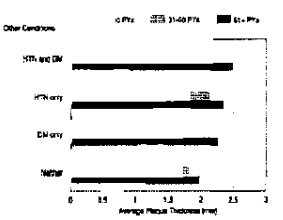
Smoking & Atherosclerosis
Non-cardiac Biomarkers

- Carotid Artery Disease
  - Intimal-medial wall thickness (*Ultrasound*)
  - Arterial-lumenal narrowing (*Doppler Velocities*)
- Peripheral Vascular Disease
  - Ankle/Brachial Index (*ABI*)
    ABI = systolic BP in leg ÷ systolic BP in arm
  - Severity of Claudication (*Exercise time & distance*)

Smoking & Carotid Artery Atherosclerosis

Independent Risk Factors of Increased Wall Thickness
- Pack-years ($p<0.0005$)
- Age ($p<0.0001$)
- HTN ($p<0.004$)



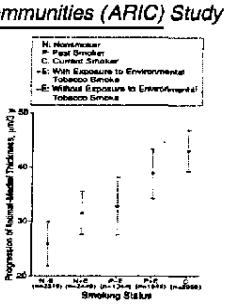
Dempsey et al. *Stroke* 1992

n=790

Progression of Carotid Disease
The Atherosclerosis Risk in Communities (ARIC) Study

Smoking & 3-year progression
- Continual smoking-50%
- Environmental tobacco-25%

n=10,914



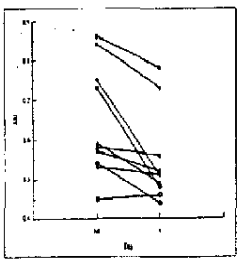
Howard et al. *JAMA* 1998

Smoking & Peripheral Vascular Disease

Ankle/brachial Index (ABI)
Acute Smoking decreased ABI in chronic smokers with claudication

n=10

Yataco et al. *Angiology* 1999



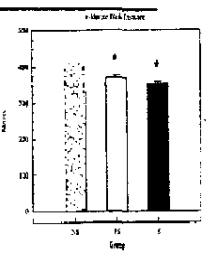
Smoking Status & Functional Limitation

Walk Distance in 6 minutes

Among patients with claudication and similar levels of calf blood flow, non-smokers walk further than former smokers who in turn, walk further than persistent smokers.

n=415

Cahan et al. *Angiology* 1999



Subjective Biomarkers
Estimates of 'Quality of Life'

- Short Form 36 Item Health Survey (SF-36)
  - 36 questions used as Medical Outcomes Data
    - Includes 8 domains (physical functioning, role functioning, social functioning, mental health, pain, emotional, energy/fatigue & general health.
    - Accepted, reliable and previously validated
- Sickness Impact Profile (SIP)
  - 146 questions to establish 14 subscales
  - More cumbersome and less sensitive than SF-36
- Seattle Angina Questionnaire

Biomarkers for Studies on Smoking
Summary

- 'Macro' biomarkers are relevant but impractical
  - * Death, MI, Stroke, Loss of limb require large # of subjects
- Biomarkers of myocardial ischemia are practical
  - * EKG is inexpensive but ? accuracy
  - * Nuclear imaging (SPECT & PET) is sensitive but ? cost
  - * 2D ECHO/Doppler is available but ? reproducibility
  - * Fast CT Scan & MRI needs further validation and ? cost
- Biomarkers of cerebral & peripheral atherosclerosis
  - * Ultrasound/Doppler of carotids is feasible but ? reproducibility
  - * ABIs and exercise testing for claudication but ? sensitivity

Selection of the optimal biomarker for any study involving smoking

- **Cost of the project**
- **Hypothesis of the project**
- **Clinical relevance of the marker**
- **Availability of the marker**
- **Predictive accuracy of the marker**
- **Reproducibility of the marker**

Notes: